A QUANTITY AND COST ESTIMATE OF THE ANATOMY AND RESEARCH BUILDING OF MICHIGAN STATE COLLEGE

Thesis for the Degree of B. S.
MICHIGAN STATE COLLEGE

J. E. Blanchard

1942

THESIS

A Quantity and Cost Estimate of the Anatomy and Research Building of Michigan State College

A Thesis Submitted to

The Faculty of

MICHIGAN STATE COLLEGE

of

AGRICULTURE AND APPLIED SCIENCE

by

J. E. Blanchard

Candidate for the Degree of

Bachelor of Science

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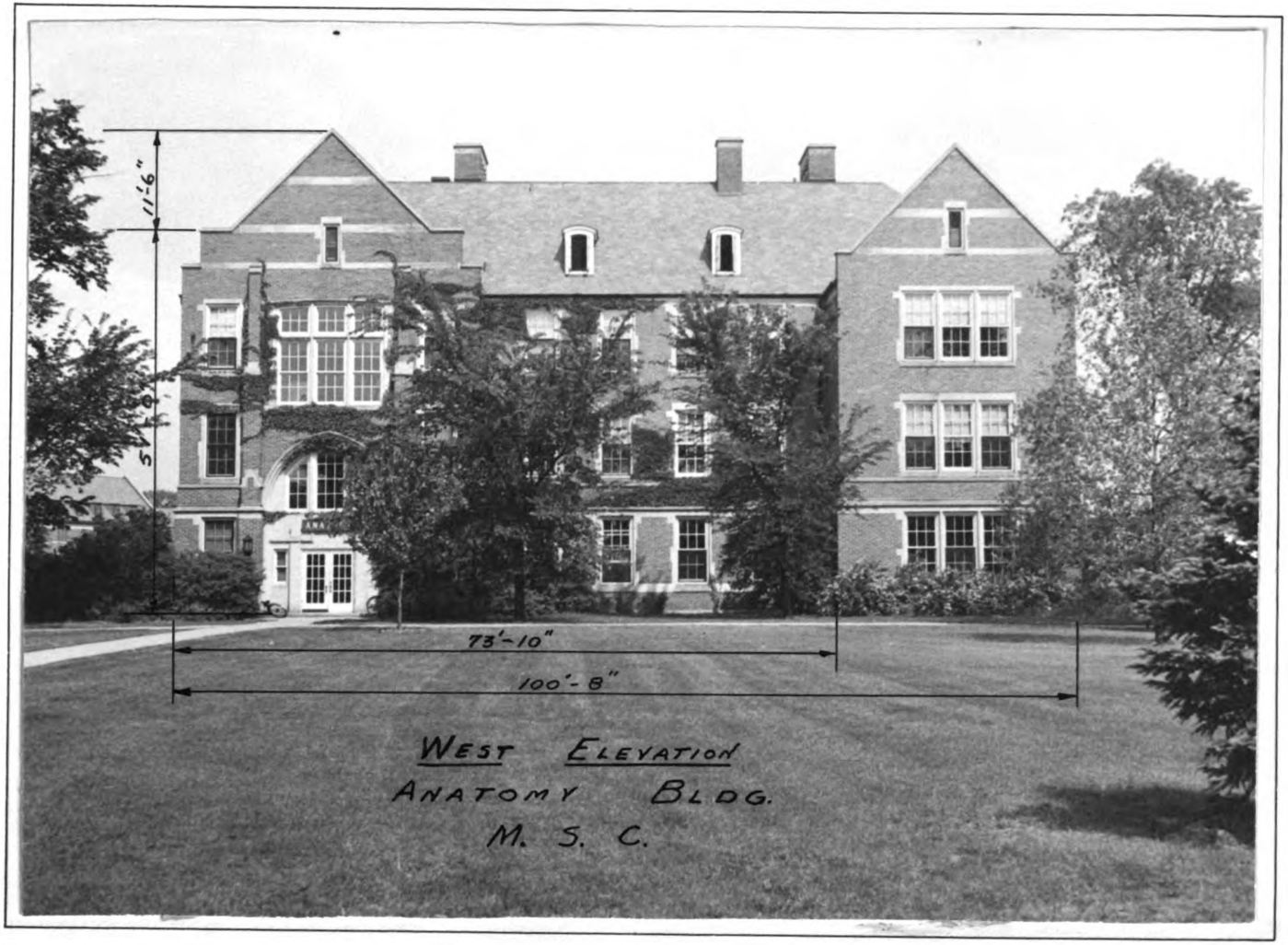
INTRODUCTION

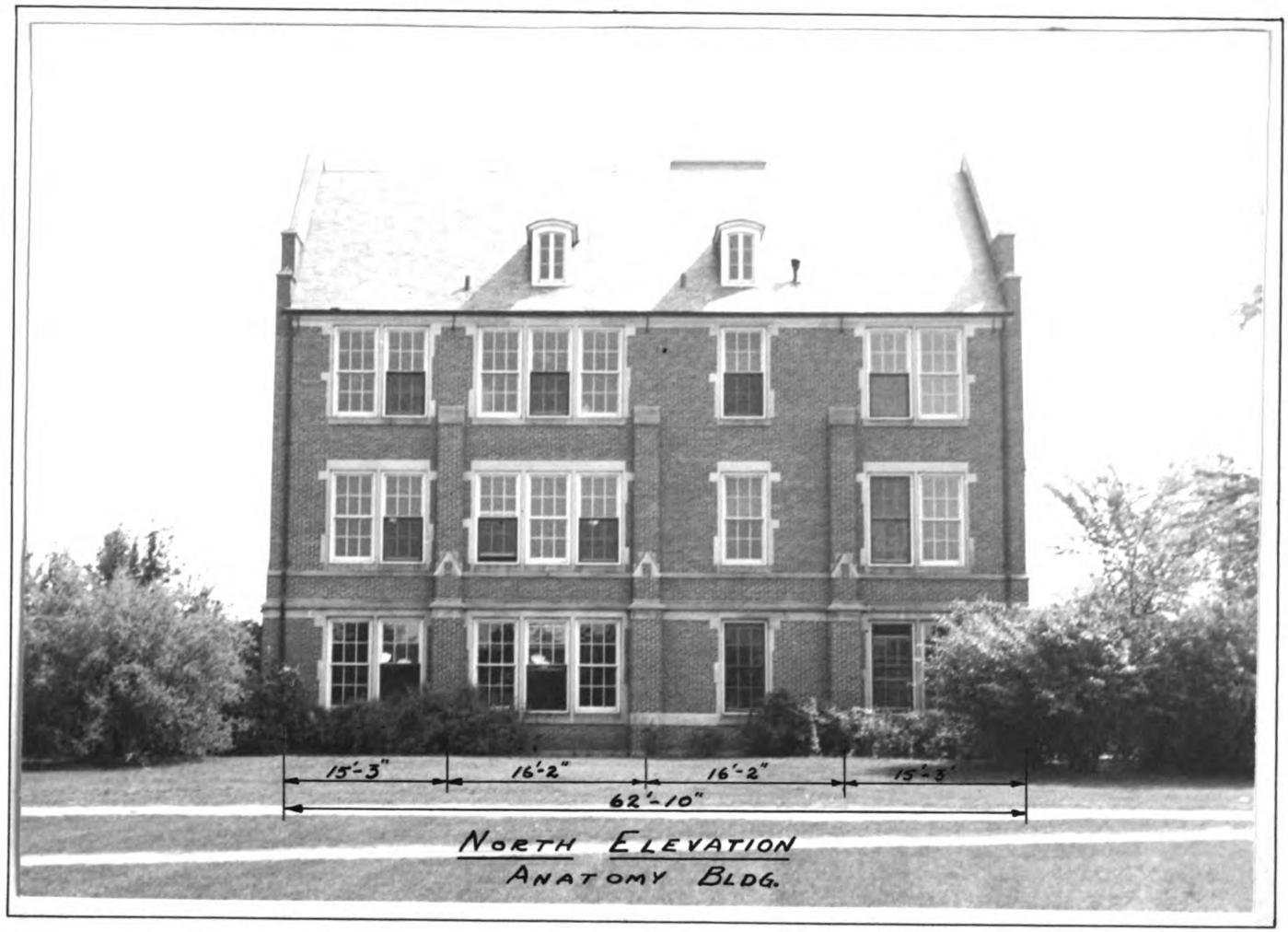
The plans and specifications of the Anatomy and Research Building were acquired from Bowd & Munson, Michigan State College architects. Using these plans and specifications, a quantity estimate was first made, checking from time to time with the contractor of this job, Reniger Construction Company. From the quantity estimate the estimate of cost of materials and labor was made. The Engineering News-Record, Vol. 128: No. 17: Pages 595-735, April 23, 1942, was used as reference for materials prices as of December, 1941, and any reference made to this magazine will be indicated by "ENR". The union wage rates for construction trades were acquired from the Lansing Building and Construction Trade Council, an affiliate of the Building Trades Department of the American Federation of Labor. Any reference made to CONSTRUCTION ESTIMATES AND COSTS by H. E. Pulver, B.S., C.E., University of Wisconsin, McGraw-Hill Book Company, Inc., 1940, will be indicated hereinafter as "text".

The period of six months to complete the building was arrived at by the comparison of this building with one of comparable size that I followed through to completion.

In a number of instances the complete size of materials were omitted from Specifications and Drawings of the Architect. Due to my own inexperience at guessing what was meant, the size of some of the materials I used may not be accurate.



WEST ELEVATION
ANATOMY BLDG.
M. S. C.

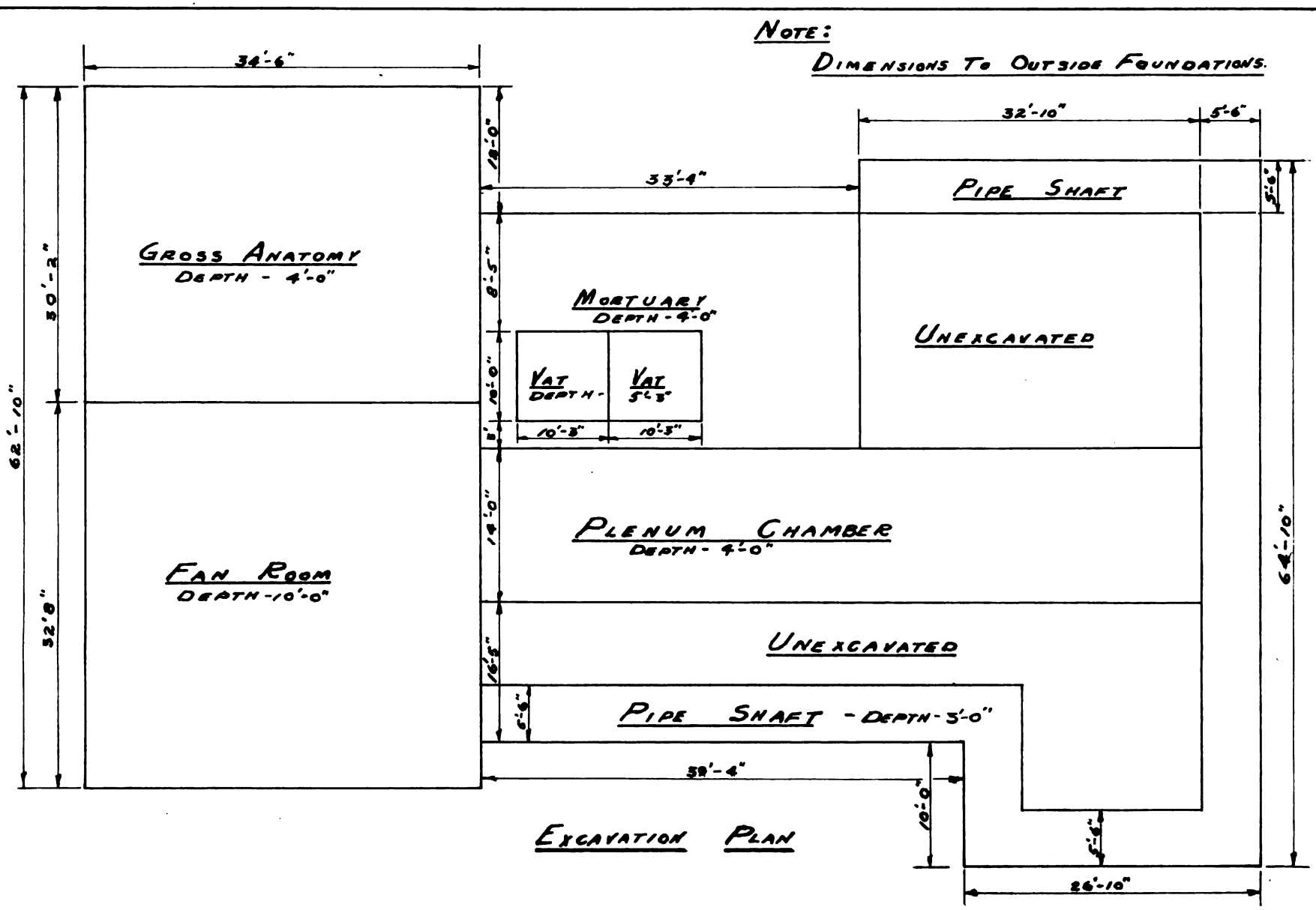


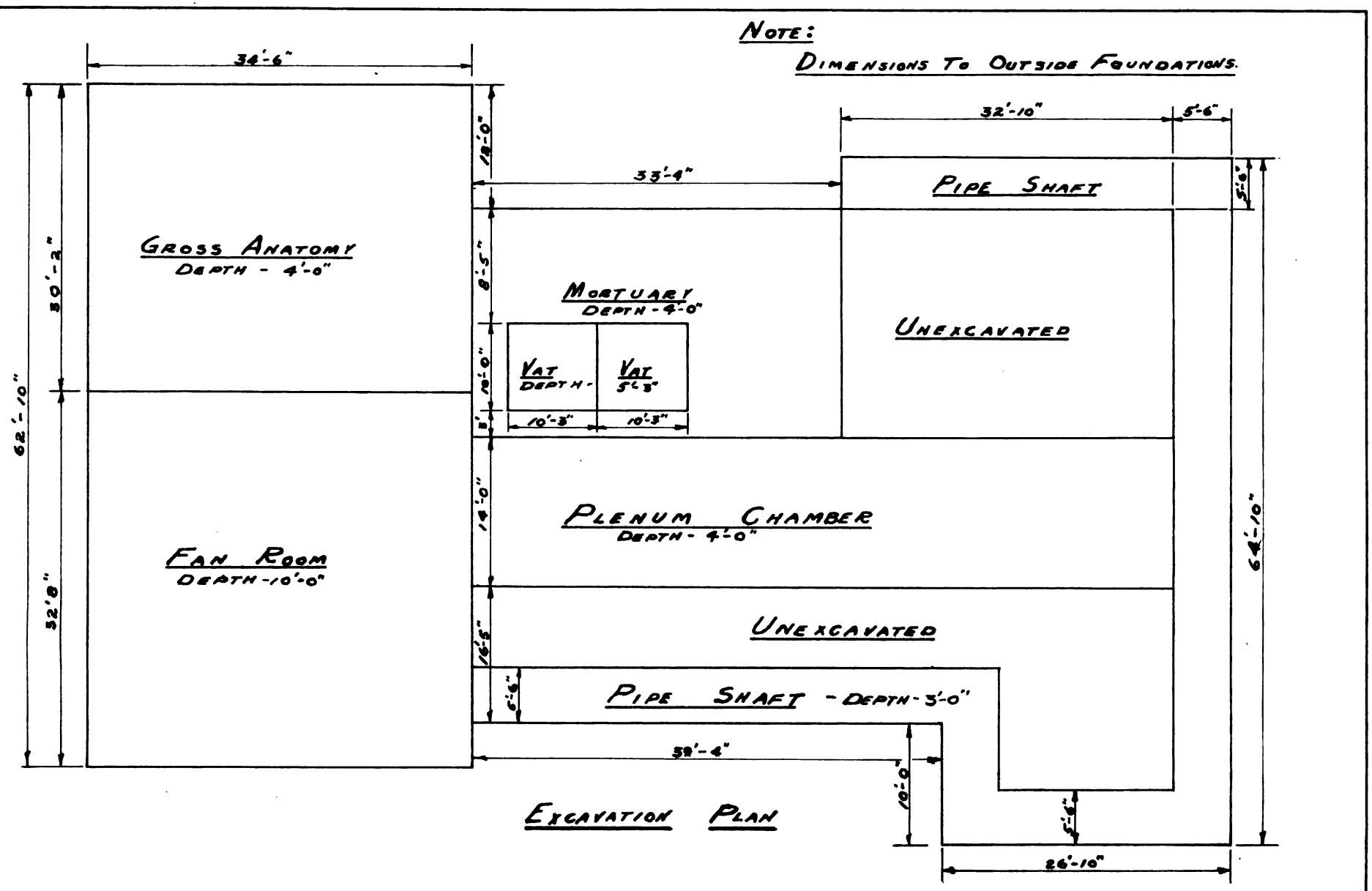
NORTH ELEVATION
ANATOMY BLDG.

General Summary

General Expense	$ 8,413.
Excavation	926.
Drains	143.
Foundations	4,563.
Reinforced Concrete	7,336.
Reinforcing	3,779.
Cement Work	1,672.
Kalman Floors	2,770.
Waterproofing	114.
Brickwork	6,836.
Interior Partitions	11,530.
Cut Stone and Granite	7,866.
Rough Carpentry	1,405.
Finished Carpentry and Millwork	6,249.
Structural Steel	3,636.
Miscellaneous Iron	682.
Rough Hardware	225.
Finished Hardware	1,715.
Incinerator	5,630.
Roofing and Sheet Metal	4,167.
Metal Windows	21.
Terrazzo and Marble	1,600.
Metal Partitions	140.
Lockers	395.
Mirror and Shelves	101.
Painting and Decorating	2,852.
Refrigerator	300.
Elevator and Elevator Enclosures	1,709.
Blackboard	135.
Glass and Glazing	1,060.
Linoleum	463.
Caulking	295.
Lath and Plaster	2,656.
	$91,384.
Performance Bond 1%	914.
Maintenance Bond 1%	914.
	$93,212.
Profit 15%	13,980.
	$107,192.

General Expense	Unit Cost	Labor	Mat.	Total
Superintendent 6 mos. @ $400.		2400.		
Timekeeper 6 mos. @ $200.		1200.		
Office and Sheds			300.	
Equipment			300.	
Tools			100.	
Concrete Tower and Hoist				
Material " " "			300.	
Temporary Water			100.	
Temporary Power			100.	
Temporary Light			50.	
Temporary Heat				
Temporary Toilet			50.	
Temporary Phone			25.	
Photos			25.	
Barricades and Lights			50.	
Clean Up			500.	
Permit				
Liability Insurance $22,600. @ 3.50			791.	
Fire " (By Owner)				
Social Security Tax 2% ($22,600)			453.	
Michigan Use or Sales Tax 3% of $55,618			1669.	
		$3600.	$4815.	$8415.


NOTE:
DIMENSIONS TO OUTSIDE FOUNDATIONS.
34'-6"
62'-10"
30'-2"
32'8"
GROSS ANATOMY
DEPTH - 4'-0"
FAN ROOM
DEPTH - 10'-0"
18'-0"
33'-4"
8'-5"
MORTUARY
DEPTH - 4'-0"
VAT
DEPTH -
VAT
5'-3"
10'-3"
10'-3"
8'
18'-0"
14'-0"
PLENUM CHAMBER
DEPTH - 4'-0"
16'-8"
6'-4"
32'-10"
5'-6"
PIPE SHAFT
5'-6"
UNEXCAVATED
UNEXCAVATED
PIPE SHAFT - DEPTH - 5'-0"
39'-4"
10'-0"
5'-6"
64'-10"
26'-10"
EXCAVATION PLAN


NOTE:
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34'-6"
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VAT
DEPTH-
VAT
5'-3"
10'-3"
10'-3"
8'
14'-0"
16'-5"
6'-6"
39'-4"
10'-0"
32'-10"
5'-6"
PIPE SHAFT
5'-6"
UNEXCAVATED
PLENUM CHAMBER
DEPTH-4'-0"
UNEXCAVATED
PIPE SHAFT - DEPTH-3'-0"
5'-6"
64'-10"
26'-10"
EXCAVATION PLAN

GENERAL ESTIMATE

		Unit Cost	Labor	Mat.	Total
Excavation					
Top Soil					
105'0" x 48'0" x 0'8"	3360 ft.^{3}				
30'0" x 10'0" x 0'8"	200				
36'0" x 5'0" x 0'8"	120				
38'0" x 12'0" x 0'8"	304				
38'0" x 1'0" x 0'8"	26				
	4010 ft.^{3}				
Labor 148½ cu. yd.			.75		111.

*Text--Table 3-3, p. 54:

1 cu. yd. per labor hr.
Union wage, 75¢ per hr.

General Excavation

Fan Room	38'0" x 36'0" x 10'0"	13,680 ft.^{3}		
Areas 2	9'0" x 4'0" x 6'0"	432		
Gr. Anat.	38'0" x 29'0" x 4'0"	4,408		
Mortuary & Plenum	35'0" x 36'0" x 4'0"	5,040		
Plenum	14'0" x 32'0" x 4'0"	1,792		
Pipe Space	8'0" x 150'0" x 3'0"	3,600		
Vats	13'0" x 24'0" x 5'3"	1,638		
		30,590 ft.^{3}		

Labor 1130 cu. yd.

*Text--Table 3-5, p. 56:

Transportation--
3/4 c.y. shovel $ 30.00
Assume shovel cap. 45 c.y. per hr. Therefore, 1130/45 = 25.2 hr. req. to complete excavation. Labor for shovel operator @ 1.50/hr 37.80

* Computations

			Unit Cost	Labor	Mat.	Total
General Excavation (Con't)						
*Text--Table 2-5, p. 28:						
1 truck 2 minutes to load, 5 minutes round trip, total 7 minutes; use 4 trucks. Labor 4 truck drivers at 80¢ per hr.		$ 80.64				
Labor at dump, 2 men at 75¢ per hr.		37.80				
*Text--Appendix B--trucks:						
Expense/day 1 truck $14.50						
$\frac{25.2 \text{ hr.}}{8 \text{ hr/da}}$ x 14.5 = $45.75						
4 trucks at $45.75 =		183.00				
Shovel expense		61.00				
750 yd. to dump is 2250' 1000' free haul leaving 25 stations of overhaul. Use 1¢/station/cu. yd. as cost of overhaul, or 1130 x 25 x .01 =		280.20				
		$710.44				
Labor	1130 cu. yd.			.63		712.
Footing and Trench Excavation						
5	6'6" x 6'6" x 5'0"	1,050 ft.^{3}				
9	5'6" x 5'6" x 1'0"	270				
2	3'3" x 3'3" x 1'0"	21				
	165'0" x 2'4" x 1'0"	453				
	173'0" x 2'0" x 1'0"	346				
	10'6" x 14'0" x 1'0"	147				
	4'6" x 7'0" x 1'0"	31				
		2,318 ft.^{3}				

*Computations

		Unit Cost	Labor	Mat.	Total
Footing and Trench Excavation (Con't)					
*Text--Table 3-8, p. 60:					
86 cu. yd.					
.75/hr., rate for com. labor					
.8 cu yd/man/hr of excav.					
Excavation-					
.75 x .8 x 86	$51.60				
Backfull-					
.75 x .4 x 86	25.80				
Equipment	4.00				
Total cost	$81.40				
Labor 86 cu. yd.		.95	82.		
Cinder Fill					
204 sq. ft. x 8" thick (spec.)					
Material 5 cu. yd.					
Cost as per quotations of Ward Gravel Company, Lansing		1.25		6.	
Labor					
See Backfill for rate		.50	2.		
Back Fill					
Labor					
See Footing and Trench Excavation.					
Surplus Material					
Specifications:					
"All surplus earth from excavations shall be piled in a convenient place or shall be carted away by the contractors, as may be directed"					
Test Borings					
Labor (estimated) 14		.90	13.		

* Computations

Drains	Unit Cost	Labor	Mat.	Total
4" Tile Drains--Material 490'0"				
Cost of tile from ENR, p. 158	.08		40.	
Labor	.10	49.		
4" Bends--Material for 53 bends	.27		15.	
Labor	.10	5.		
Tarpaper over Joints				
Material 540 joints	.01		5.	
Labor	--			
Cinder or Gravel Fill				
540'0" x 1'0" x 0'3" 135 ft.^{3}				
Material--Ward Gravel Co., Lansing 5 c.y.	1.25		6.	
Labor for fill same as before	.50	2.		
Excavation				
540'0" x 1'0" x 1'0"				
*Text--Table 3-8, p. 60:				
Excavation costs-				
.75 x .85 x 20 c.y. = $12.75				
Back Fill				
.75 x .425 x 20 = 6.38				
Equipment allowance 2.00				
$21.13				
$\frac{21.13}{20}$ = $1.05/c.y.				
Labor 20 cu. yd.	1.05	21.		
		$997.	$72.	$1069.

*Computations

			Unit Cost	Labor	Mat.	Total

Foundations

Column Footings

		ft.^{3}	ft.^{2}
1	5'6" x 5'6" x 1'3"	38	28
3	5'8" x 5'8" x 1'3"	120	85
3	5'0" x 5'0" x 1'2"	88	70
3	5'4" x 5'4" x 1'2"	99	75
4	5'7" x 5'7" x 1'3"	156	111
2	3'0" x 3'0" x 1'0"	18	24
Caps.			
3	2'0" x 2'2" x 1'0"	13	25
11	2'2" x 2'2" x 1'0"	61	113
		593	531

Proportion 1 : $2\frac{1}{2}$: 4 by weight

*Text--Page 131--formulas:

1 cu. yd. of concrete assumed to weigh 4000#

Sacks of cement/c.y. of concrete $= \frac{42.5 \times 1}{1+.8+2.5+4}$

$= 4.84$ sacks/cubic yard

Lbs of water/cu. yd. of concrete $= \frac{4000 \times .8}{1+.8+2.5+4}$

$= 364\#$ of $H_2O = \frac{364}{8.35} = 43.6$ gal./cu. yd.

Tons of Sand/cu. yd. of concrete $= \frac{2 \times 2.5}{1+.8+2.5+4}$

$= .602$ tons/cu. yd.

Tons of Gravel/cu. yd. of conc. $= \frac{2 \times 4}{1+.8+2.5+4}$

$= .964$ tons/cu. yd.

Cost of Materials from ENR, p. 154 as of December, 1941--

cement $2.14/bbl	=	.54/sack
sand	=	.91/ton
gravel	=	1.31/ton

4.84 sacks @ .54	$2.62
.602 tons @ .91	.55
.964 tons @ 1.31	1.26
Cost of Mat./cu. yd.	$4.43

*Computations

	Unit Cost	Labor	Mat.	Total

Column Footings (Con't)

Plant Costs--Concrete
*Text--Table 5-12, p. 139:

Storage and weighing	$ .05
Mixing	.30
Placing	.60
Curing	.05
Total plant costs	$ .90

Therefore,
Total cost of conc. = .90 4.43 = 5.33/c.y.

Labor - Concrete
*Text--Table 5-11, p. 137:

	Labor-hr/c.y.
Machine Mixing	1.0
Placing in footings	2.0
Curing in ordinary weather	.7
Total	3.7

Average hourly wage = 75¢

Therefore,
Labor/c.y. = .75 x 3.7 = $2.78/c.y.

Forms - Material 531 ft.^{2}
*Text--Table 5-2, p. 119:

Col. Footing takes 200 board feet for 100 sq. ft. of surface, or 2 board feet for 1 sq. ft. of surface. ENR cost per 1000 ft. b.m. $46.00 on p. 160. Then by diagram 5-1 on p. 570, text, and knowing cost per 1000 ft. b.m. and number of board feet to cover 1 sq. ft. of surface, it was found that material per sq. ft. of surface is 9¢.

Labor--Text--Table 5-3, p. 121:

	Labor-hrs/100 ft.^{2} of surface		
	Assem.	Erect	Strp & Cln
Ftgs & Piers	3	2	3

Total 8 Labor-hours

* Computations

			Unit Cost	Labor	Mat.	Total
Column Footings (Con't)						
Forms--Labor (con't)						
Labor wage per hour	=	$1.25				
Labor-hrs/100 ft.^{2}	=	8				
By Diagram 5-2, p. 571, text						
cost /ft.^{2}	=	$ .10				
Summary:						
Material 22 cu. yd.) Concrete			5.33			117.
Labor)			2.78	61.		
Material 531 sq. ft.) Forms			.09			48.
Labor)			.10	53.		

Wall Footings

		Concrete	Forms
7	1'6" x 3'6" x 1'0"	37 ft.^{3}	21 ft.^{2}
	17'0" x 2'0" x 1'0"	48	34
	340'0" x 2'5" x 1'0"	822	680
	73'0" x 1'8" x 1'0"	288	346
2	5'6" x 3'0" x 1'0"	33	28
	9'0" x 13'0" x 1'0"	117	44
	4'0" x 6'6" x 1'0"	26	8
		1371 ft.^{3}	1161 ft.^{2}

Proportion 1 : $2\frac{1}{2}$: 4

*In as much as the proportion for concrete for wall footings is the same as for column footings, the unit costs will be the same.

			Unit Cost	Labor	Mat.	Total
Summary:						
Material 50 3/4 cu. yd.) Concrete			5.33			270.
Labor)			2.78	141.		
Material 1161 sq. ft.)			.09			104.
Labor)			.10	116.		

* Computations

Walls

			Conc. ft.^{3}		Forms ft^2
7	2'6" x 1'6"	x 13'0"	341		455
	17'0" x 1'10"	x 13'0"	405		442
	15'0" x 1'6"	x 1'0"	23		30
	49'0" x 1'5"	x 13'0"	921		1299
	176'0" x 1'5"	x 5 '0"	748		1056
	34'6" x 1'5"	x 5'8"	276		391
	32'6" x 0'4"	x 4'8"	---	52	--
	146'0" x 0'8"	x 4'0"	389		1168
	106'0" x 0'8"	x 5'0"	353		1060
2	1'8" x 0'6"	x 4'0"	7		27
2	1'8" x 0'9"	x 4'0"	10		27
	3'0" x 3'0"	x 5'0"	45		30
	9'0" x 0'8"	x 1'0"	6		18
	20'0" x 0'8"	x 5'0"	67		200
	5'0" x 0'8"	x 5'6"	18		55
2	4'0" x 0'8"	x 5'4"	29		85
2	4'0" x 0'8"	x 4'4"	23		69
2	4'0" x 0'8"	x 3'4"	19		53
	16'0" x 0'8"	x 11'3"	120		360
	17'0" x 0'8"	x 6'6"	74		221
	76'0" x 1'5"	x 5'0"	615		886
	76'0" x 0'4"	x 4'8"	--	118	---
2	2'6" x 0'4"	x 13'0"	22		130
2	2'6" x 0'4"	x 5'0"	10		58
	22'6" x 0'8"	x 10'6"	157		473
	32'8" x 0'8"	x 6'4"	137		412
	67'0" x 0'4"	x 5'2"	115		692
	67'0" x 0'6"	x 5'0"	168		670
	67'0" x 0'6"	x 3'0"	100		402
	23'4" x 0'8"	x 7'6"	116		350
			5312	170	11119

*The proportion for the concrete for the walls is the same as for wall and column footings and labor for placing concrete in walls will be approximately the same as placing concrete in footings, hence the unit costs can be considered as the same.

Summary:

			Unit Cost	Labor	Mat.	Total
Material	190 cu. yds.	Concrete	5.33			1013.
Labor			2.78	528.		
Material	11,119 sq. ft.	Forms	.09			1000.
Labor			.10	1112.		
				$2011.	$2552.	$4563.

*Computations

		Unit Cost	Labor	Mat.	Total
Reinforced Concrete					
Columns					

		Conc. $ft.^3$	Forms $ft.^2$
Base-	4 1'2" x 1'2" x 12'0"	65	224
ment	1 1'2" x 1'0" x 12'0"	14	52
	2 1'0" x 1'0" x 12'0"	24	96
1st,	3 1'2" x 1'2" x 10'0"	41	140
2nd,	6 1'2" x 1'2" x 5'4"	44	149
3rd,	8 1'2" x 1'2" x 12'0"	131	448
Flrs.	5 1'2" x 1'0" x 12'0"	70	260
	29 1'0" x 1'0" x 12'0"	348	1392
		737	2761

Mix 1 : 1 : 2

Concrete - 27 cu. yds. of material

*Text--p. 131--formulas:

1 cu. yd. of concrete assumed to weigh 4000#

Sacks of cement/c.y. of conc. $= \frac{42.5 \times 1}{1+.44+1+2}$

$= 9.6$ sacks

Tons of sand/c.y. of conc. $= \frac{2 \times 1}{1+.44+1+2}$

$= .45$ tons

Tons of gravel/c.y. of conc. $= \frac{2 \times 2}{1+.44+1+2}$

$= .90$ tons

Costs of materials from ENR, p. 154 as of December, 1941:

Cement	.54 per sack x 9.6	=	$5.27
Sand	.91 per ton x .45	=	.41
Gravel	1.31 per ton x .90	=	1.18
Water			.01
			$6.87

Plant Costs--Text--Table 5-12, p. 139: Same as before .90

Total cost of conc. $7.77

* Computations

	Unit Cost	Labor	Mat.	Total

Columns (Con't)

Labor Costs
*Text--Table 5-11, p. 137:

	Labor-hr./c.y.
Machine Mix	1.0
Placing in columns	2.5
Curing in ordinary weather	.7
	4.2 hr/c.y.

*Text--Table 5-15, p. 145:

	Labor-hr/1 bar
Placing bars 10' to 20' long	.2
Total time	4.4 hr/c.y.

Labor rate/hr is $.75
By text Diagram 5-6, p. 575 it was found that labor cost per cu. yd. is $3.30

Form Cost--Material 2760 ft.^{2}
*Text--Table 5-2, p. 119:
It requires 190 ft. b.m. for 100 ft.^{2} of surface of 1.9 ft. b.m. for 1 ft.^{2} of surface.

ENR Cost/1000 ft. b.m. is $46.00
*Text--Diagram 5-1, p. 570
It was found that lumber cost per ft.^{2} of surface is 8¢.

Form Cost--Labor
*Text--Table 5-3, p. 121:

	Labor-hr/100 ft.^{2} of surface
Columns--assembel	6.0
erect	2.0
strip & clean	2.0
Total	10.0

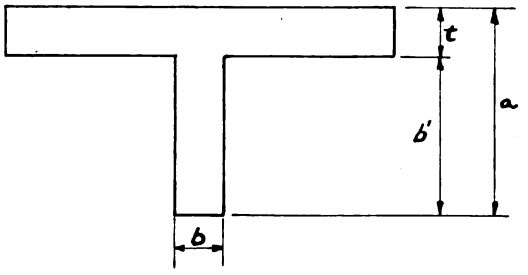
* Computations

Columns (Con't)

			Unit Cost	Labor	Mat.	Total
Labor rate is $1.25 per hr.						
*Text--Diagram 5-2, p. 571: Form labor cost was found to be .12/ft.^{2}						
Summary:						
Material	27 cu. yd.	Concrete	7.77		210.	
Labor		Concrete	3.30	89.		
Material	2760 ft.^{2}	Forms	.08		220.	
Labor		Forms	.12	331.		

Beams

The quantities are to be the underside of the slabs.



b - beam thickness

b'- beam height

L - length of beam

a - total over all height

t - slab thickness

*Computations

							Unit Cost			
								Labor	Mat.	Total
Beams (Con't)										
Beam No.	No. of	L	b/a	t	ft.^{3}	ft.^{2}	Bottom area			
1	9	7'6"	8/16	8"	30	89	45			
2	2	14'8"	8/22	2"	32	98	20			
2		14'8"	8/24	2"	18	54	10			
3	6	7'8"	8/16	8"	20	61	32			
4	9	11'8"	8/18	8"	58	175	70			
5	6	12'0"	8/20	8"	48	144	48			
6	6	13'6"	8/20	8"	54	162	54			
7	6	11'8"	8/18	8"	39	116	46			
8		15'0"	9/11	4"	7	18	12			
9	2	16'4"	8/16	10"	11	33	22			
10	3	8'0"	10/10	4½"	10	22	20			
11		15'0"	12/16	4"	15	30	15			
12	2	16'4"	8/14	10"	7	21	22			
13	4	18'6"	12/12	12"	---	---	74			
14	2	10'0"	10/12	6"	8	20	17			
15	2	4'8"	6/12	--	5	19	5			
16	3	14'6"	8/20	2"	43	130	29			
17	2	8'0"	12/12	4"	11	21	16			
18		8'0"	9/11	4"	3	9	6			
		8'0"	7/10	2"	3	10	4			
		8'0"	9/12	--	6	16	6			
		8'0"	6/14	2"	4	16	4			
		8'0"	8/15	2"	6	17	5			
19	2	18'6"	10/20	12"	21	49	30			
20		10'0"	8/20	6"	8	23	7			
21		4'8"	6/20	--	4	16	2			
22		14'8"	8/24	2"	18	54	10			
23	3	11'8"	8/20	8"	24	70	23			
L 1&2	2	8'0"	8/16	2"	13	37	11			
L 3&5	3	14'0"	8/16	1'2"	5	14	28			
	6	14'0"	6/16	1'2"	7	28	42			
L 4	3	9'6"	8/16	1'0"	10	29	19			
	6	9'6"	6/16	1'3"	14	57	28			
L 6	2	10'0"	8/16	12"	7	20	14			
	4	10'0"	6/16	12"	10	40	20			
	11	5'6"	8/16	12"	20	61	40			
	22	5'6"	6/16	12"	30	121	60			
L 7		14'0"	8/16	12"	5	14	10			
	2	14'0"	6/16	12"	7	28	14			
L 8	2	18'0"	8/16	1'2"	4	12	24			
	4	18'0"	6/16	1'2"	6	24	36			
B-35		15'0"	12/20	6"	18	35	15			
B-36	2	10'0"	8/14	9"	6	17	13			
B-37	2	5'4"	8/14	7"	4	12	7			
B-38		16'0"	8/12	--	11	32	11			
	Totals				656	1941	1046			

	Unit Cost	Labor	Mat.	Total

Beams (Con't)

Proportion 1 : 2 : 4 by weight

Concrete--24 cu. yd. of material
*Text--Page 131--formulas:

1 c.y. of concrete assumed to weigh 4000#

Sacks of cement/c.y. of conc. = $\frac{42.5 \times 1}{1+.4+2+4}$

= 5.75 sacks

Tons of sand/c.y. of concrete = $\frac{2 \times 2}{1+.4+2+4}$

= .54 tons

Tons of gravel/c.y. of conc. = $\frac{2 \times 4}{1+.4+2+4}$

= 1.08 tons

Costs of materials from ENR, p. 154, as of December, 1941

Cement - $.54/sack x 5.75	=	$3.11
Sand - .91/ton x .54	=	.49
Gravel - 1.31/ton x 1.08	=	1.41
Water		.01
Material cost/c.y.		$5.02
Plant cost--same as for reinforced conc. columns	=	.90
Total cost of conc./c.y.		$5.92

Labor--Concrete

*According to table 5-11, p. 137 in the text it requires the same amount of labor-hours/c.y. to mix, place and cure concrete for reinforced columns as for reinforced beams, therefore, the labor cost per c.y. will be the same.

* Computations

		Unit Cost	Labor	Mat.	Total
Beams (Con't)					
Forms--Material	2987 ft.^{2}				
*Text--Table 5-2, p. 119: Beams and girders take 250 ft. b.m. for 100 ft.^{2} of surface or 2.5 ft. b.m. for 1 sq. ft. of surface.					
ENR, p. 160--cost per 1000 ft.b.m. is $46.00. Then by diagram 5-1 on p. 570 of the text, and knowing cost per 1000 ft. b.m. and number of board feet to cover 1 sq. ft. of surface, it was found that material per sq. ft. of surface is 10¢.					
Forms--Labor The form labor for beams will be the same as was required for the reinforced concrete columns--12¢ per sq. ft.					
Summary:					
Material	24 cu. yds.) Concrete				
Labor	)			5.92	142.
			79.	3.30	
Material	2987 sq. ft.) Forms				
Labor	)			.10	299.
			358.	.12	

Flat Slabs

			ft.^{3}	ft.^{2}
Corridor	2	86'6" x 8'8" x 4½"	570	1517
		83'6" x 8'8" x 4½"	271	724
Plenum		61'6" x 12'0" x 5"	307	738
Tunnel		136'0" x 4'6" x 4"	204	612
Landings	3	16'0" x 5'0" x 4"	80	240
	2	6'0" x 16'0" x 6⅛"	104	192
	3	8'8" x 6'0" x 4"	52	156
		33'0" x 9'0" x 4"	99	297
Air & Elev shfts.		11'6" x 6'6" x 4"	25	75
		Total	1687	4476

* Computations

	Unit Cost	Labor	Mat.	Total

Flat Slabs (Con't)

Concrete--Material and Labor

*In as much as the proportion for concrete for flat slabs is the same as for beams, the unit cost for concrete material will be the same, $5.92. Also, according to the text--table 5-11 it requires no more labor-hours per cu. yd. for mixing, placing, and curing concrete for beams than it does for slabs, therefore the labor cost per cu. yd. of concrete for slabs will be the same as for beams, $3.50.

Forms--Material, 4476 ft.^{2}
*Text--Table 5-2, p. 119:

Floors require 180 ft. b.m./100 ft.^{2} of surface which equals 1.8 ft. b.m. per ft.^{2}

ENR, p. 160--cost of 1000 ft. b.m. is $46.00.

Text--Diagram 5-1, p. 570:
Cost per sq. ft. is 9¢.

Forms--Labor
*Text--Table 5-3

	Labor-hr./100 ft.^{2} of surface
Floors - assemble	3
- erect	2
- strip and clean	2
	7 labor-hrs.

Labor rate per hour is $1.25

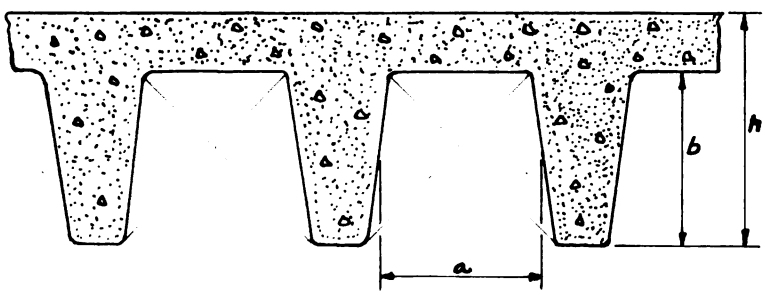
*Text--Diagram 5-2, p. 571:
Cost per sq. ft. is 9¢/

* Computations

Flat Slabs (Con't)

			Unit Cost	Labor	Mat.	Total
Summary:						
Material	63 cu. yd.	Concrete	5.92		373.	
Labor		Concrete	3.30	208.		
Material	4476 ft.^{2}	Forms	.09		403.	
Labor		Forms	.09	403.		

Steel Pan and Joist Construction



First figure total height "h" as solid concrete then deduct space taken up by pan as indicated by diagonal lines. A 12" pan means that b = 12". "a" of these pans is always 1'8".

		Unit Cost	Labor	Mat.	Total

Steel Pan and Joist Construction (Con't)

	h	Conc.	Forms	12"	10"	8"
3 25'8" x 27'4" x 1'2"		2456	2105	--	--	--
3 11	@ 26'0"	---	---	858'	--	--
3 31'0" x 27'4" x 1'2"		2966	2542	--	--	--
3 13	@ 26'0"	---	---	1014'	--	--
2 25'0" x 22'0" x 1'0"		1100	1100	--	--	--
1 25'0" x 22'0" x 1'½"		573	550	--	--	--
3 11	@ 20'6"	---	---	--	676'	--
3 42'0" x 17'4" x 10"		1820	2184	--	--	--
3 19	@ 15'8"	---	---	--	--	884'
3 33'0" x 14'8" x 10"		1210	1452	--	--	--
3 15	@ 13'6"	---	---	--	--	607'
1 32'6" x 18'0" x 10"		487	585	--	--	--
1 15	@ 16'6"	---	---	--	--	241'
3 23'0" x 19'0" x 1'0"		1311	1311	--	--	--
3 9	@ 18'0"	---	---	--	486'	--
2 16'6" x 18'0" x 10"		495	594	--	--	--
2 6	@ 16'6"	---	---	--	--	198'
3 10'6" x 13'6" x 1'0"		425	425	--	--	--
3 4	@ 12'6"	---	---	--	150'	--
1 16'8" x 18'0" x 10"		250	300	--	--	--
1 8	@ 17'0"	---	---	--	--	136'
16'0" x 11'6" x 8"		123	184	--	--	--
		13216	13332	1872	1312	2066
		ft.^{3}	ft.^{2}	ft.	ft.	ft.

7 @ 15'0" = 105'0" of 6" tile

Deduct from form area the bottom area computed under beams, thus form area =

13332 ft.^{2} - 1046 ft.^{2} = 12286 ft.^{2}

Deduct from Concrete:

12" pan - 1872'	@ 1'8" x 1'0"	=	3120 ft.^{3}
10" pan - 1312'	@ 1'8" x 10"	=	1822 ft.^{3}
8" pan - 2066'	@ 1'8" x 8"	=	2296 ft.^{3}
6" tile - 105'	@ 1'8" x 6"	=	87 ft.^{3}
5355' of pans			7325 ft.^{3}

Actual amount of concrete = 13216 - 7325 =

5891 ft.^{3} or 218 cu. yds.

Steel Pan and Joist Construction (Con't)

			Unit Cost	Labor	Mat.	Total
Material:						
218 cu. yds. of concrete						
12286 sq. ft. of forms						
Concrete--Material and Labor						
*The proportion for concrete for this joist construction is the same as for beams and also slabs. It is reasonable then to assume the unit costs to be the same, $5.92 per cu. yd. The labor will also be about the same as slabs in as much as the pouring of the two is one and the same operation as specified. It would be illogical to charge a different price for the same operation.						
Forms--Material and Labor						
*By using the sheet-steel cores or pans the wood form material has been reduced very much. It is necessary to use wood forms only on the bottom side of the joist and these forms have already been figured under "Beams". After consulting the Reniger Construction Company it was decided that the cost per sq. ft. of sheet-steel core forms would be about the same as the labor and material cost per sq. ft. of forms in the case of slabs. The metal forms are removed and used several times which aids in reducing the cost per sq. ft.						
Summary:						
Material	218 cu. yds.	Concrete	5.92		1290.	
Labor			3.30	719.		
Material	12,286 sq. ft.	Forms	.09		1106.	
Labor			.09	1106.		
				$3293.	$4043.	$7336.

*Computations

Reinforcing

	Unit Cost	Labor	Mat.	Total
This part of the contract was sub-let. The information for this was procured from The Reniger Construction Company. This being the case the bids of the sub-contractors are used.				
Bars				
Material including:				
Base material				
Size of extras				
Binding extras				
Cutting				
Bundling and tagging				
Freight			2995.	
Labor 29 tons	15.00	435.		
Cartage	2.00	58.		
Steel Tile				
Material Bid				
Labor 12,286 sq. ft.	1½¢	184.		
Attached Lath				
Material 1400 sq. yd. Bid				
Labor	.05	70.		
Cartage		9.		
Wire Mesh				
Slabs on ground 6" x 6" as spec.				
Material 4635 sq. ft. Bid				
Labor	½¢	23.		
Cartage		5.		
		$784.	$2995.	$3779.

		Unit Cost	Labor	Mat.	Total

Cement Work

Finished Floors on Ground

4" thick and 1 : 2 : 3 mix groute. Top finish to be of 1 to 2 Portland cement, homogeneous with concrete groute as specified 1" thick.

Tunnel	160'0" x 3'6"	560 ft.^{2}
Plenum	61'6" x 10'8"	655 "
Fan Room	32'0" x 76'6"	848 "
" "	18'0" x 4'0"	72 "
" "	5'6" x 5'2"	28 "
	4" thick x	2163 ft.^{2}

Concrete

Material--about 26.7 cu. yd.

*Text--Page 131--formulas:

Proportion 1 : 2 : 3 by weight

1 cu. yd. of concrete assumed to weigh 4000#

Sacks of cement/c.y. of conc. $= \frac{42.5 \times 1}{1+.67+2+3}$

$= 6.37$ sacks

Tons of sand/c.y. of conc. $= \frac{2 \times 2}{1+.67+2+3}$

$= .6$ tons

Tons of gravel/c.y. of conc. $= \frac{2 \times 3}{1+.67+2+3}$

$= .9$ tons

*Costs of materials from ENR, p. 154 as of December, 1941.

Cement @ .54/sack x 6.37	=	$3.44
Sand @ .91/ton x .6	=	.55
Gravel @ 1.31/ton x .9	=	1.81
Cost of Mat./c.y.		$5.17
Plant costs as before		.90
Total cost of conc.		$6.07

*Computations

	Unit Cost	Labor	Mat.	Total

Cement Work (Con't)

Concrete--Labor
*Text--Table 5-11, p. 137:

	Labor-hr/c.y.
Machine mixing	1.0
Placing in Floors & Slabs	2.0
Curing in ordinary weather	.7
	3.7 hrs.

Average wage per hour is $ .75

Therefore,
Labor/c.y. = .75 x 3.7 = $2.78

Homogeneous Top Finish--Material

2160 ft.^{2} of 1" thick = 6.67 cu. yds.

*Text--Page 131--formulas:

Sacks of cement/c.y. = $\frac{42.5 \times 1}{1+2}$ = 14.2 sacks

Tons of sand/c.y. = $\frac{2 \times 2}{1+2}$ = 1.33 tons

Cost of Material from ENR, p. 154 as of December, 1941

Cement @	$ .54/sack x 14.2	=	$7.67
Sand @	.91/ton x 1.33	=	1.21
			$8.88
Plant costs as before			.90
Cost of concrete/c.y.			$9.78

Homogeneous Top Finish--Labor
Assume labor cost to be about $\frac{1}{4}$ as much as for the labor costs for groute as there is about $\frac{1}{2}$ as much material. Cost will be $2.00/c.y.

*Computations

Cement Work (Con't)			Unit Cost	Labor	Mat.	Total
Finished Floors on Ground						
Summary:						
Material	26.7 cu. yd.	Concrete	6.07		162.	
Labor			2.78	74.		
Material	6.67 cu. yd.	Top	9.78		65.	
Labor			2.00	13.		

Rough Concrete Slabs on Ground (4" concrete)

These slabs are to receive "Kalman Process" floors which is the same as terrazzo.

	Plus	Minus
25'0" x 20'6"	513	---
4'0" x 6'0"	---	24
21'6" x 36'0"	774	---
20'6" x 10'0"	---	205
46'0" x 11'0"	506	---
32'0" x 28'6"	912	---
	2705 -	229 =

2476 ft.^{2} of 4" slab = 30.6 cu. yd.

Concrete--Material			
Same as for finished floors on ground	6.07		186.
Concrete--Labor			
Same as for finished floors on ground	2.78	85.	

Cement Finish on Structeral Slabs

1" top finish of 1 to 2 Portland cement

	Plus	Minus
99'0" x 47'0"	4653	---
32'0" x 17'0"	544	---
24'0" x 10'0"	240	---
6'0" x 11'6"	---	69
2 3'6" x 9'6"	---	66
3'0" x 3'0"	---	9
	5437 -	144 =

			Unit Cost	Labor	Mat.	Total
Cement Finish on Structural Slabs (Con't)						
5293 ft.^{2} of 1" thickness = 16.3 cu. yd.						
Unit costs of cement finish on structural slabs will be the same as for top finish on ground floors.						
Summary:						
Material	16.3 cu. yd.	Concrete	9.78		159.	
Labor			2.00	33.		
Ramp Slab						
6½" of concrete with a 1½" top finish as specified.						
12 x 17 = 204 ft.^{2} of 6½" conc. = 4.1 c.y.						
204 ft.^{2} of 1½" finish = .945 c.y.						
Unit costs of ramp slab will be same as for the preceeding slabs.						
Summary:						
Material	4.1 cu. yd.	Concrete	6.07		25.	
Labor			2.78	11.		
Material	.945 cu. yd.	Finish	9.78		9.	
Labor			2.00	2.		
Vat Floors						
Unit costs same as for above.						
2 at 9'3" x 8'8" = 160 sq. ft.						
Summary:						
Material	1.97 c.y. unfin. conc.		6.07		12.	
Labor			2.78	6.		
Material	2.96 cu. yd.	6" slab conc.	6.07		18.	
Labor			2.78	8.		
Material	.5 cu. yd.	1" Finish	9.78		5.	
Labor			2.00	1.		

	Unit Cost	Labor	Mat.	Total

Concrete Stairs

Reinforced Slab, $6\frac{1}{2}$" thick

	Concrete
2 14'0" x 4'0"	112 ft.^{2}
7'0" x 7'0"	49 "
2 13'0" x 4'0"	104 "
8'0" x 7'0"	56 "
14'0" x 4'0"	56 "
	377 ft.^{2}

Concrete Material--7.56 cu. yd.

As was previously estimated under beams and flat slabs, the cost of concrete is $6.18 per cu. yd. and the cost of labor is $2.78 per cu. yd. which may also be used for the unit costs of concrete for stairs.

Form--Material

From Reniger Construction Company estimate--754 ft.^{2}

*Text--Table 5-2, p. 119:
Stairs--number of board feet per 100 sq. ft. is 300 which is 3 ft. b.m. per 1 sq. ft.

ENR, p. 160, cost per 1000 ft. b.m. is $46.00

*Text--Diagram 5-1, p. 570:
Cost per sq. ft. of surface is 14¢

Form--Labor

*Text--Table 5-3, p. 121:

Stairs	Labor-hours/100 ft.^{2}
Assemble	6
Erect	4
Strip and clean	3
	13 hrs/100 ft.^{2}

*Computations

Concrete Stairs (Con't)

			Unit Cost	Labor	Mat.	Total
Labor rate per hour is $1.25						
*Text--Diagram 5-2, p. 571: Cost per sq. ft. of surface is 16¢ for finish						
Summary:						
Material	7.56 cu. yd.	Concrete	6.18		47.	
Labor			2.78	21.		
Material	754 ft.^{2}		.14		105.	
Labor			.16	121.		

Concrete Stairs--Reinforced Slab 4½"

48	@ 4'0"	=	192	ft.^{2}
4	@ 3'6"	=	14	ft.^{2}
4	@ 3'0"	=	12	ft.^{2}
7	@ 3'0"	=	51	ft.^{2}
2	@ 3'6"	=	7	ft.^{2}
			276	ft.^{2} of 4½" slabs = 3.86 cu. yd.

Reniger Construction Company estimate for forms is 552 ft.^{2} for these stairs.

The unit costs of 4½" slab concrete slabs will be the same as for 6½" slabs,

Summary:

Material	3.86 cu. yd.	Concrete	6.18		24.	
Labor			2.78	11.		
Material	552 ft.^{2}	Forms	.14		77.	
Labor			.16	88.		

* Computations

			Unit Cost	Labor	Mat.	Total
Stair Rail						
180'0" x 3'4" x 4" = 215 ft.^{3} of concrete or 8 cu. yd. of concrete and 1264 ft.^{2} for forms.						
Unit costs same as flat slabs.						
Summary:						
Material	8 cu. yd.	Concrete	6.18		50.	
Labor			2.78	21.		
Material	1264 ft.^{2}	Forms	.08		101.	
Labor			.09	114.		
4" Concrete Table Top						
Anatomy Technical Laboratory						
3'6" x 18'0" = 63 sq. ft. for forms = 3/4 cu. yd. concrete						
Same unit costs as above						
Summary:						
Material	3/4 cu. yd.	Concrete	6.18		5.	
Labor			2.78	2.		
Material	63 ft.^{2}	Forms	.08		5.	
Labor			.09	6.		
					$617.	**$1055.** **$1672.**

			Unit Cost	Labor	Mat.	Total
Kalman Process Floors--Terrazzo						
		sq. ft.				
Over Tunnel		612				
Rough Conc. (Ground)		2475				
Gross Anatomy	24'0" x 25'0"	600				
Museum	36'6" x 15'0"	458				
Lecture Room	25'0" x 30'0"	750				
Anat. Tech. Lab.	20'0" x 22'0"	440				
Prep. Room	20'0" x 12'0"	240				
Histology	32'0" x 31'0"	1008				
Museum	24'0" x 25'0"	600				
Research	30'6" x 15'0"	458				
Student Lab.	25'0" x 30'0"	750				
Research	20'0" x 24'0"	480				
Student Lab.	32'0" x 14'0"	459				
Research Lab.	13'0" x 24'0"	312				
	13'0" x 4'4"	46				
		9688				
Less		510				
		9178				
Finish on Stairs	56 ft.^{2}					
Finish on Landings	20 ft.^{2}					
Vat Wall Finish	183 ft.^{2}					
Table Top Finish	63 ft.^{2}					
This part of Bid was sub-let to Kalman Floor Company at a bid price of $2770.00 including labor. This information was procured from The Reniger Construction Company						2770.
						$2770.

Waterproofing	Unit Cost	Labor	Mat.	Total
Data from Reniger Construction Company				
Integral waterproofing--2# per sack				
Material 220#	.10		22.	
Labor		--		
Surface waterproofing--2 coats				
Material 2265 ft.^{2}	1½¢		34.	
Labor	.01	23.		
Membrane Waterproofing				
Material 493 ft.^{2}	.04		20.	
Labor	.03	15.		
		$ 38.	$ 76.	$ 114.

			Unit Cost	Labor	Mat.	Total
Brickwork						
Face Brick						
				ft.^{2}	- ft.^{2}	
2	10'6"	x 10'6"		220		
2	32'0"	x 4'6"		288		
3	2'0"	x 4'6"			27	
	35'0"	x 38'6"		1348		
124	3'8"	x 7'6"			3410	
3	3'8"	x 4'0"			45	
1	3'8"	x 7'0"			26	
2	2'6"	x 5'6"			27	
2	1'8"	x 4'2"			14	
	4'8"	x 7'8"			36	
	8'0"	x 10'6"			84	
	5'6"	x 11'0"			60	
	8'0"	x 2'6"			20	
	6'4"	x 7'0"			44	
14	1'0"	x 12'0"		168		
14	0'8"	x 14'6"		135		
	40'0"	x 35'0"		1400		
	36'10"	x 38'8"		1424		
	65'0"	x 35'0"		2275		
	38'0"	x 38'8"		1470		
	30'0"	x 3'8"		110		
	9'6"	x 9'6"		90		
	46'0"	x 35'0"		1610		
	34'0"	x 38'8"		1315		
3	2'8"	x 5'8"			45	
	63'0"	x 35'0"		2205		
4	9'4"	x 2'6"		93		
8	3'0"	x 2'6"		60		
4	7'6"	x 2'0"			60	
				14211	3894	
Deduct cut stone				6706	2812	
					6706	
				7505 ft.^{2}		
				of brick surface		

*Text--Table 6-2, p. 169:

Assume about 6 1/3 bricks per sq. ft.

7505 sq. ft. at 6 1/3 is 47,530 bricks

Reference--Specifications paragraph #3:
"The face brick shall be a shale brick costing $32.00 delivered at site; and shall have a selected range of color.

*Computations

	Unit Cost	Labor	Mat.	Total

Brickwork (Con't)

Mortor

In as much as mix is not given, I am assuming a mix of 1 part cement, 1 part lime, and 4 parts sand--Reference--Building Construction by W. C. Huntington, C. E., John Wiley and Son, Inc., 1929, p. 135.

*Text--Table 6-4, p. 172:

Materials required/c.y. of mortor by weight:

Cement -- 6.4 sacks	x .54	=	$ 3.46
Lime -- 600 lbs.	x .01	=	6.00
Sand -- 1.2 tons	x .91	=	1.09
Cost per cu. yd.		=	$10.55

*Text--Table 6-3, p. 171:

It takes .56 cu. yd. of mortor per 1000 standard brick with a $\frac{1}{2}$" joint, therefore mortor cost per 1000 brick is $10.55 x .56 = $5.90

Labor--Face Brick

*Text--Table 6-5, p. 174:

Hours per 1000 brick	=	12.5
Hourly wage of bricklayer	=	$1.65
Hourly wage of helper	=	$ .85

Therefore,

12.5 x 1.65 + 12.5 x .85 = $31.23/1000 brick.

Cleaning of 7505 sq. ft. of brick wall--assume $1\frac{1}{2}$¢ per sq. ft. to clean brick.

Wall Ties

1 tie per 6 sq. ft., Therefore, about 8,000 ties at $3.00 per thousand.

*Computations

Face Brick (Con't)

	Unit Cost	Labor	Mat.	Total
Summary:				
Material 47½ thousand bricks	32.00		1520.	
Mortor " " "	5.90		280.	
Labor " " "	31.23	1483.		
Clean 7505 sq. ft.	1½¢	113.		
Wall ties 8,000	3.00		24.	

Combined Count

		ft.³	- ft.³
8	2'0" x 38'0" x 4"	203	
	352'0" x 1'4" x 12'	5632	
39	3'8" x 1'4" x 7'6"		1430
2	1'8" x 1'4" x 4'2"		18
	6'0" x 1'4" x 7'0"		56
	7'8" x 1'4" x 2'4"		23
	5'6" x 1'4" x 10'6"		77
	8'0" x 1'4" x 10'0"		107
3	352'0" x 0'8" x 1'0"		704
7	2'6" x 1'6" x 12'0"	315	
	352'0" x 1'0" x 24'6"	8624	
85	3'8" x 1'0" x 7'6"		2337
3	3'8" x 1'0" x 4'0"		44
	3'8" x 1'0" x 7'0"		26
	22'6" x 0'8" x 11'0"	165	
2	2'6" x 1'0" x 5'6"		27
	4' 8" x 1'0" x 7'8"		36
3	2'0" x 1'0" x 4'6"		27
7	1'10" x 1'0" x 4'0"	41	
7	1'10" x 0'8" x 12'0"	103	
4	1'4" x 0'8" x 12'0"	43	
2	34'0" x 1'0" x 2'6"	170	
2	30'0" x 1'0" x 4'6"	270	
	21'4" x 1'0" x 10'6"	224	
	26'0" x 1'0" x 2'6"	65	
½	21'6" x 1'0" x 11'0"	118	
	32'0" x 1'0" x 2'6"	80	
	28'0" x 1'0" x 4'6"	126	
½	17'0" x 1'0" x 9'6"	81	
4	11'6" x 0'8" x 4'0"	123	
4	2'6" x 0'8" x 59'0"	393	
		16776 ft.³	4912 ft.³

		Unit Cost	Labor	Mat.	Total
Combined Count (Con't)					
Deduct Face Brick	2502 ft.^{3}				
" Cut Stone	1435				
" Backup Tile	4639				
" Glazed Tile	2048				
" Fire Brick	67				

16,776 - 15,603 = 1173 ft.^{3}

*Text--Table 6-2, p. 169:

Number of bricks per cu. ft. is 19

Therefore,

19 x 1173 = 22½ thousand

Cost per 100 is $13.50 from ENR

Mortor

Same as Face brick mortor $5.90/1000

Labor

Assume 1/3 cost of labor for face brick because this back up brick does not require the care of face brick laying, which is $12.00

Unload Brick

*Text--Table 2-1, P. 19:

Pick up and pile 1000 brick is 2 1/3 hrs. Therefore, it takes 2 1/3 x $.85 = $1.98 per 1000 bricks to unload.

Summary:

Material	22½ thousand bricks	13.50		304.
Mortor	" " "	5.90		133.
Labor		12.00	270.	
Unload		1.98	45.	

		Unit Cost	Labor	Mat.	Total

Brickwork(Con't)

8" Backup Tile (5" x 8" x 12")

		- ft.^{2}	- ft.^{2}
	87'0" x 11'0"	957	
2	17'0" x 8'0"		272
4	13'0" x 8'0"		416
7	4'0" x 8'0"		224
	97'0" x 11'0"	1067	
	9'0" x 3'0"		27
	74'0" x 11'0"	814	
6	2'0" x 10'0"	120	
3	9'0" x 8'0"		216
	77'0" x 11'0"	847	
	67'0" x 11'0"	737	
7	4'0" x 8'0"		224
	6'0" x 8'0"		48
	13'0" x 13'0"		169
2	9'0" x 8'0"		144
	14'0" x 30'0"	420	
	12'0" x 24'0"	288	
	14'0" x 28'0"	392	
	14'0" x 7'0"		98
4	11'6" x 16'0"	736	
		6378	- 1838

= 4628 ft.^{2} = 11,100 tiles

Material

1 tile = 5 x 12 - 144 = .417 ft.^{2}

Therefore,

4628 - .417 = 11,100 tile

*ENR cost, p. 162: Cost per 1000 tile is $74.50 is $ .0745 per tile.

So, .0745 x 11,100 = $827

Mortor

*Text--page 191

"Average amount of mortor is about .2 - .25 c.y. per 100 tile". I will assume .23 c.y. per 100 tile

*Text-Table 6-10, p. 191:

Assume a mix of 1 : 3 then,

cement (sacks)	= 9 x $.54 =	$4.86
lime (ton)	= .045 x $16.50=	.74
sand (ton)	= 1.25 x .91 =	1.14
Cost/1 c.y./100 tile		$6.74

*Compensation

Brickwork (Con't)	Unit Cost	Labor	Mat.	Total

Material

Cost--ENR, p. 154--cement and sand;
p. 162--lime

Therefore, 11,100 tile/100 is 111 in lots of 100 tile. But it requires only .23 c.y. per 100 tile So $6.74 x .23 is $1.55 per 100 tile in this case. Total cost is 1.55 x 111 is $172.00

Labor

*Text--Table 6-11, p. 192:
Mason 2.5 hr. per 100 tile
Helper 3.5 hr. per 100 tile
or a total of 6 hr/100 tile

Mason, $1.65 per hr.
Helper, .85 per hr.
Total $2.50 per hr.

*Text--Diagram 6-12, p. 591:
Cost per black = $.15

Total cost = .15 x 11100 = $1665.

Summary:

Material	11,100 pieces	.0745		827.
Motor	per 100 tile	1.55		172.
Labor	per piece	.15	1665.	
			$3576.	$3260. $6836.

*Computations

			Unit Cost	Labor	Mat.	Total
Interior Partitions & Glazed Tile Furring						
Glazed Tile						
Exterior Walls				4"	2"	
				+ -	+ -	
Gross Anat.	72'6" x 15'4"	1112				
	2 12'0" x 7'6"		180			
	7'10" x 7'6"		59			
	2 3'8" x 7'6"		55			
Mortuary	35'0" x 15'4"	537				
	2 7'0" x 7'6"		117			
	7'4" x 7'0"		51			
Gross Anat.	61'0" x 10'8"	651				
	12'0" x 7'6"		90			
	2 3'8" x 7'6"		55			
	16'2" x 7'6"		121			
Autopsy	84'4" x 10'8"	956				
	16'2" x 7'6"		121			
	7'4" x 3'0"		22			
	12'0" x 7'6"		90			
	3'8" x 7'6"		28			
	3'0" x 3'0"		9			
Locker	20'0" x 10'8"	213				
	2 3'8" x 7'6"		55			
2nd Fl.	267'0" x 10'8"	2848				
	4 12'0" x 7'6"		360			
	2 16'2" x 7'6"		242			
	4 7'0" x 7'6"		234			
	7 3'8" x 7 '6"		193			
3rd. Fl.	278'0" x 10'8"	2965				
	4 12'0" x 7'6"		360			
	2 16'2" x 7'6"		242			
	4 7'0" x 7'6"		234			
	8 3'8" x 7'6"		220			
1st Fl.	162'0" x 10'8"	1728				
	57'0" x 5'0"	285				
	20'0" x 7'0"		140			
	20'0" x 5'0"			100		
	35'0" x 10'8"			374		
	2 3'0" x 7'0"				42	
	15'6" x 10'8"			165		
2nd Fl.	164'6" x 10'8"	1755				
	38'0" x 4'0"		152			
	22'0" x 7'0"		154			
	11'0" x 4'0"				44	
	49'6" x 10'8"			522		
	3'0" x 7'0"				21	
3rd Fl.	156'6" x 10'8"	1669				
	9 3'0" x 7'0"		189			

	Unit Cost	Labor	Mat.	Total

Glazed Tile (Con't)

	4" +	4" -	2" +	2" -
10'0" x 4'0"		40		
18'6" x 10'8"			197	
3'0" x 7'0"				21
20'0" x 10'8"	215		215	
	14932	3815	1571	128
	-3815		-128	
	11119		1443	
	ft.^{2}		ft.^{2}	

It requires about 3 1/3 tile of the 4" and the 2" tile used to make 1 sq. ft. as specified.

Therefore, 3 1/3 x 11,119 = 37,060 pieces of 4" tile, and 3 1/3 x 1443 = 4,800 pieces of 2" tile

Material--4" starke glazed bricktile

37,060 pieces

ENR, p. 162: Cost per 1000 tile is $81.60 which will be $.0816 per piece. Total cost is $3024.

Mortor

It will require approximately 1/2 as much mortor for a 4" tile as for the preceeding 8" tile, so the cost will be 1/2 as much or 78¢ per 100 tile. Total cost is 370.60 x $.78 = $289.

Labor

*Text--Table 6-11, p. 192:

Due to tile being smaller than those found in table, I will assume values a little smaller than those listed.

Mason(hrs. per 100 tile)	= 1.25
Helper (" " " ")	= 1.75
Total hrs/100 tile	3.00

*Text--Diagram 6-12, p. 591:

Labor rate--Mason	$1.65 per hr.
Helper	.85 per hr.
Total	$2.50 per hr.

Cost per tile is $.07 or $70 per 1000 tile or a total of $2594.

*Computation

	Unit Cost	Labor	Mat.	Total

Glazed Tile (Con't)

Cleaning 11,120 ft.^{2}

Mason--Hours per 100 ft.^{2} is 1.25
Labor rate/hour for Mason is $1.65

*Text--Table 6-12, p. 192 for above.

*Text--Table 6-12, p. 591:
Cost per sq. ft. is 1½¢
Total cost, 11120 ft.^{2} x 1½¢ is $167.

Material--2" stark glazed brictile

4800 pieces
Cost same as 4" tile is $81.60 per 1000, Total cost is $81.60 x 4.8 is $392.

Mortor
A 2" tile will require half as much mortor as a 4" tile, so cost will be half as much or $.39 per 100 tile
Total cost is .39 x 48 = $19.00

Labor
Same as 4" tile or $70 per 1000 tile
Total cost is 4.8 x 70 = $336.

Clean
Same as 4" tile or 1½¢ per sq. ft.
Total cost is 1443 x 1½¢ = $22.

Summary:

4" tile--Material	37060 pieces	8.16		3024.
Mortor	370.6 pieces	.78		289.
Labor	37060 pieces	.07	2594.	
Clean	11119 sq. ft	1½¢	167.	
2" tile--Material	4800 pieces	8.16		392.
Mortor	48 pieces	.39		19.
Labor	4.8 pieces	70.00	336.	
Clean	1443 sq. ft	1½¢	22.	

	Unit Cost	Labor	Mat.	Total
Special Shapes				
By recommendation of Mr. Reniger of Reniger Construction Company the Special Shapes will be figured by taking 25% of the total cost of ordinary shapes. Therefore 25% of $6843 is $1710				1710.

4" Glazed Tile (Faced both sides)

3rd Fl.	120'8" x 10'8" =	1287 ft.^{2}	
2nd Fl.	55'0" x 10'8" =	587 "	
3	3'0" x 7'0" =		63 ft.^{2}
1st Fl.	13'9" x 10'8" =	147 "	
		2021 - 63 =	
		1958 ft.^{2}	

Number of tile is 1958 x 3 1/3 = 6527

Material--6527 pieces
ENR, p. 162: Cost per 1000 tile is $86.60 or $.0866 per piece.
Total cost 6527 x .0866 = $565.

Mortor
Same amount as for 4" starke glazed bricktile. Cost 78¢ per 100 tile.
Total cost is 65.27 x .78 = $51.

Labor
Will be approximately the same as labor for glazed bricktile. Cost is $70. per 1000 tile. Total cost is 6.527 x 70 = $457.

Clean
Faced on both sides and cleaned on both sides. Total area to clean is 2 x 1958 = 3916 ft.^{2} Cost is also same as glazed bricktile. Cost per sq. ft. is 1½¢.
Total cost is 3916 x 1½¢ = $59.

Summary:

Material	-- 6527 pieces	8.66		565.
Mortor	-- 65.27 100 pieces	.78		51.
Labor	-- 6.527 1000 pieces	70.00	457.	
Clean	-- 3916 ft.^{2}	1½¢	59.	

		Unit Cost	Labor	Mat.	Total

Interior Partitions

		6" +	6" -	4" +	4" -
1st Floor					
	33'4" x 10'4"	344			
	16'6" x 10'6"	174			
	16'0" x 11'0"	176			
	13'0" x 11'0"	143			
9	3'0" x 7'0"				189
	30'6" x 11'0"			335	
	177'0" x 10'6"			1859	
	12'0" x 7'0"		84		
	16'0" x 10'6"	160			
	29'0" x 10'0"	319			
2nd Floor					
	38'0" x 4' 0"			152	
	12'6" x 11'6"	131			
	252'6" x 10'6"			2651	
6	3'0" x 7'0"				126
3rd Floor					
	201'0" x 10'8"			2144	
6	3'0" x 7'0"				126
	10'0" x 11'8"			110	
	21'0" x 10'6"	220			
		1667	84	7251	441
		-84		-441	
		1583 ft.^{2}		6810 ft.^{2}	
Attic					
25	4'0" x 3'0"			300	
	34'0" x 15'0"			510	
				7620 ft.s	

6" tile - 12" x 12" face

Material 1583 ft.^{2}

*Text--Table 6-12, p. 196:
6" tile cost per tile is 16¢ which is also 16¢ per sq. ft. Total cost is 1583 x .16 = 253.

Mortor

*Text--Table 6-14, p. 198:
Cu. yds. of mortor per 100 sq. ft. is .14 c.y., cost per c.y. for back up tile was $6.74; so cost per 100 sq. ft. is .14 x $6.74 = $.95 Total cost 9½¢ x 1583 = $15.

			Unit Cost	Labor	Mat.	Total
Interior Partitions (Con't)						
Labor						
*Text--Table 6-15, p. 199: Mason labor for 100, 12" x 12" x 6" tile is 4 hr. Labor rate, mason plus helper is $2.50.						
*Text--Diagram 6-12, p. 591: Cost per sq. ft. is 10¢ Therefore, total cost is 1583 x .10 = $158.						
4" tile --12" x 12" face						
Material--7620 sq. ft. Cost is approximately 2/3 that of 6" tile as there is a reduction of 1/3 amount of material. Therefore, cost per sq. ft. is 11¢ Total cost is 7620 x .11 is $838.						
Labor Same method as for material computation. Cost per sq. ft. is 7¢ Total cost is 7620 x .07 is $533.						
Mortor Same method as before Cost per 100 sq. ft. is $ .63 Total cost is 7620 x .63 = $48.						
Summary:						
Material	1583 ft.^{2}	)		.16		253.
Mortor	15.83 ft.^{2}	)	6" tile	.95		15.
Labor	1583 ft.^{2}	)		.10	158.	
Material	7620 ft.^{2}	)		.11		838.
Mortor	76.20 ft.^{2}	)	4" tile	.63		48.
Labor	7620 ft.s	)		.07	533.	
					$4326.	$5494. $11530.

*Computations

	Unit Cost	Labor	Mat.	Total
Cut Stone and Granite				
This part of the bid was sub-let by the contractor. These figures were procured from Reniger Construction Company. These figures are totals			1950.	5916.
				$1950. $5916. $7866

	Unit Cost	Labor	Mat.	Total
Rough Carpentry				
Hailers on roof purlins (2" x 4")				
1764' of purlins--see structural steel				
Material--1280 B. F.				
ENR, p. 160--cost $46.00 per M ft. b.m.				
or $.046 per ft. b.m.				
Total cost 1280 x .046 = $59.	4.6¢		59.	
Labor--1764 ft.				
Estimate using text table 8-10, p. 239				
and Diagram 897 and 898				
Result--5¢ per ft.				
Therefore, the total cost is				
1764 x .05 = $88.	.05	88.		
Bolts--Material 240	.05		12.	
Plank Cap on Vats				
Material--7 of 2" x 8" x 10' is approxi-				
mately 100 B. F.				
ENR, p. 160, cost $46.00 per M ft. b.m.				
Total cost is 100 x $.046 = $4.60	4.6¢		5.	
Labor		5.		
Plank Seats in Locker Room				
1 2" x 12" x 16'0"				
Material--32 B. F.	4.6¢		2.	
Labor		10.		
Stair Rail				
2" x 4" x 90' bolted on top				
Material 60 B. F.	4.6¢		3.	
Labor 90 ft.	.05	4.		
Wood Deck				
67'0" x 20'0" 1340				
22'0" x 50'0" 1100				
22'0" x 54'0" 1188				
22'0" x 26'6" 583				
22'0" x 59'6" 1309				
20'0" x 39'6" 790				
24'0" x 49'0" 1176 7486 @ 2.35				

Rough Carpentry (Con't)			Unit Cost	Labor	Mat.	Total
Wood Deck--con't						
Material	17.6 M		38.00		669.	
Labor			8.00	141.		
Door Bucks						
Material	3	Double Doors	1.00		3.	
Labor			2.00	6.		
Material	48	Single Doors	.75		36.	
Labor			1.50	72.		
Framing Dormers						
Material	9		5.00		45.	
Labor	9		5.00	45.		
Grounds--Estimate approximate						
5000 ft.						
Material			.01		50.	
Labor			.04	200.		
				$571.	$884.	$1405

	Unit Cost	Labor	Mat.	Total
Finished Carpentry and Millwork				
The millwork was sub-let for the finished carpentry in the amount of			3600.	
Exterior Door				
Labor				
*Text--Table 8-17, p. 254:				
1 pr entrance doors "A" and frame.				
3'0" x 7'0" x 2¼-12 Lt.	12.50	13.		
2 pr. rear entrance doors and frame "D"--				
3'6" x 7'0" x 2¼-12 Lt.	12.50	25.		
Labor-hr for ext. finsh				
Doors--double 10 hr.				
Labor rate--1.25				
Therefore, cost per set is 1.25 x 10 or $12.0				
1 pr entrance doors "G" and Frame and transom				
2'6" x 7'0" x 2¼-6 Lt.	15.60	16.		
*Labor--Table 8-17, p. 254:				
Doors and transom--12½ labor-hr.				
Therefore,				
cost per set is 1.25 x 12.5 = 15.60				
Interior Doors				
Computation in same manner as above using Table 8-18 instead.				
1 pr vestibule doors and frame "B"				
3'0" x 7'0" x 1 3/4-12 Lt.	12.50	13.		
1 set interior doors and frame "F"				
4'0" x 7'0" x 2¼--)				
4 doors Frame 14'high) Labor	20.00	20.		
1 pr interior doors and frame "E"				
2'0" x 7'0" x 1 3/4--	12.50	13.		

Finished Carpentry & Millwork (Con't)	Unit Cost	Labor	Mat.	Total
Interior Doors-con't				
"G" doors 3'0" x 7'0" x 2¼-6 Lt. 25 doors	6.00	150.		
"H" doors 3'0" x 7'0" x 1 3/4 -- 4 doors	6.00	24.		
"I" doors 2'8" x 7'0" x 1 3/4 and frame 5 doors	6.00	30.		
"J" doors 2'6" x 7'0" x 1 3/4 and frame 12 doors	6.00	72.		
Windows				
Plank frames - Pulman pulley				
"A" 3'8" x 7'6½" double hund 6 lt sash				
*Text--Table 8-17, p. 254:				
Window DH-- 6 labor-hr. req.				
Therefore, cost per window is				
6 x 1.25 = $7.50				
125 "A" sindows	7.50	938.		
"B", "C", "D", "E", "F", "G" Casement Windows--				
Labor-hrs. = 4--Table 8-17:				
Cost per window is 4 x 1.25 = $5.00				
6 windows	5.00	30.		
"H"--1'8" x 4'2" D.H. -Lt sash				
2 windows	5.00	10.		
"L"--L89" x 4'4" D. H. 1 Lt. sash				
3 windows	5.00	15.		
Picture Mould (Corridors and offices)				
*Text--Table 8-18, p. 255:				
Labor-hr per 100 ft. is 4 hr.				
Cost per 100 ft. is 1.25 x 4 = $5.00				
520 linear feet	.05	26.		
Cupboard (in Research Lab 3rd Fl.)				
*Text--Table 8-18, p. 255:				
Installing ready made cabinets etc				
8 labor-hrs--				
cost for one cabinet is 1.25 x 8	10.00	10.		

Finished Carpentry and Millwork(Con't)	Unit Cost	Labor	Mat.	Total
Counters and Cupboards *Table 8-18, used as before 9 of above	15.00	135.		
Tables(Maple Top 2' x 6") 1 6' x 10' 5 5' x 7' 6 tables	10.00	60.		
Blackboard Trim *Text table used in same way chalk trough and mould 280' of above	.13	36.		
Pulleys			1015.	
		$1634.	$4615.	$6249.

*Computations

			Unit Cost	Labor	Mat.	Total
Structural Steel						
(1 shop and 1 field coat of paint as specified.)						
Roof						
9"		1291'0" x 13.4#				17299
10"		104'0" x 15.3#				1591
9"	I	10'0" x 21.8				218
12"	I	77'0" x 31.8				2449
"	8	22'0" x 31.8				5574
"	4	18'6" x 31.8				2344
"	2	61'6" x 31.8				3911
"	4	23'0" x 31.8				2926
"	4	24'0" x 31.8				3053
"		82'0" x 31.8				2608
10"	I	38'0" x 25.4				965
9"		43'0" x 13.4				576
6"	H 8	16'0" x 20.0				2560
20"	BG 2	33'0" x 14.9				9834
"		33'0" x 113				3729
						54720
Connections						
9"&10"		-228@13#				
9"	I	1@13				
12"	I	30@13				
		259@13#				3367
Bed Plates--6 @ 75#						300
						63304
Material						
All structural shapes were sub-let for material only. Material cost for 32 tons						2755.
Labor						
*Text--Table 9-6, p. 275:						
Labor-hrs. per ton of steel is 15 hr.						
Labor rate per hour is $1.25						
Cost per ton is $1.25 x 15 = $18.75						
Total cost is 32 x $18.75 = $600.						
Field Painting						
32 tons of steel						
Labor						
"Text--Table 9-7, p. 276:						
Labor-hrs. per ton = 2 hr.						
Labor rate per hr is $1.50						
Cost per ton is $1.50 x 2 is $3.00						
Total cost is 32 x 3 = $96.00						

*Computations

Structural Steel(Con't)	Unit Cost	Labor	Mat.	Total
Cartage of 32 tons				
*Text--Table 9-6, p. 275:				
Labor-hrs per ton is 2 hrs				
Labor rate is $1.00 per hr.				
Cost per ton is $2.00				
Total cost is 32 x 2 = $64.00				
Summary:				
Material 32 tons --see page before				
Labor 32 tons	18.75	600.		
Field Painting 32 tons	3.00	96.		
Cartage 32 tons	2.00	64.		
Steel Grill				
($\frac{1}{2}$ x $1\frac{1}{2}$ Frame, $\frac{1}{2}$" sq. bars; horizontal members 1 3/4 x 1/2)				
4'8" x 7'8" = 26 ft.^{2}				
Material 26 ft.^{2}	1.00		26.	
Labor	5.00	5.00		
Hinges and Lock		5.		
Water bars for all wood windows as specified--500'	.02		10.	
Labor	.05	25.		
Bolts, Page 52 Specifications			50.	
		$795.	$2841.	$3636.

*Computations

	Unit Cost	Labor	Mat.	Total
Miscellaneous Iron				
as per Reniger Construction Company				682.
The following parts of the general estimate were sub-let. Information was procured from The Reniger Construction Company:				
Rough Hardware				225.
Finished Hardware				1715.
Incinerator				5630.
Roofing and Sheet Metal				4167.
Metal Windows				21.
Terrazzo and Marble				1600.
Metal Partitions				140.
Lockers				395.
Mirror and Shelves				101.
Painting and Decorating				2852.
Refrigerator				300.
Elevator and Elevator Enclosures				1709.
				$19537.

			Unit Cost	Labor	Mat.	Total
Blackboard						
1	18'0" x 4'0"	72				
1	20'0" x 4'0"	80				
1	11'0" x 4'0"	44				
1	12'0" x 4'0"	48				
1	10'0" x 4'0"	40				
		284 ft.^{2}				
Material and Labor						
284 ft.^{2} of Blackboard						
Cost as of Reniger Construction Co.						
Material	284 ft.^{2}		.40		113.	
Labor			.08	22.		
				$ 22.	$ 113.	$ 135.

	Unit Cost	Labor	Mat.	Total
Glass and Glazing				
Material				
Sub-let			800.	
Set glass in wood sash				
Labor--1640 lts.				
*Text-Table-15-8, p. 426:				
Labor-hrs per 100 panes is 7				
Labor rate per hr is $1.25				
Cost per 100 panes is 1.25 x 7 = $8.85				
Total cost is 16.4 x 8.85 = $145.00	8.85	145.		
Putty				
*Text--Table 15-7, p. 426:				
Pounds per 100 panes is 93				
Cost per pound is 4¢				
Cost per 100 panes is 93 x .04 $3.72				
Total cost is 16.4 x 3.72 = $61.00	3.72		61.	
Set glass in steel sash				
Same as above, only consider cost per pane instead of per 100 panes				
Labor 18 lts	.09	2.		
Putty	.04		1.	
Set glass in Doors				
Labor 258 lts	.09	26.		
Cartage and Breakage		25.		
		$198.	$862.	$1060.

*Computations

		Unit Cost	Labor	Mat.	Total
Linoleum					
3/16" thick and shall be of Armstrong or Nairn Company manufacture as specified.					
6'0" x 79'0"	474 ft.^{2}				
5'0" x 12'0"	60				
6'0" x 3'6"	21				
6'0" x 76'0"	456				
5'0" x 5'6"	28				
6'0" x 75'8"	454				
5'0" x 13'0"	65				
5'8" x 14'0"	80				
3'6" x 4'6"	16				
	1654 ft.^{2}				
This part of bid was sub-let by Reniger Construction Company Unit cost including Material, Labor and Felt base is 28¢ per sq. ft.					
1654 ft.^{2}		.28		463.	
				$463.	$463.
Caulking					
Windows					
A	124 @ 22'0"	2728			
B	1 @ 15'4"	15			
C	1 @ 15'4"	15			
D	1 @ 15'4"	16			
E	1 @ 21'4"	21			
F	1 @ 16'0"	16			
G	1 @ 16'0"	16			
H	2 @ 12'0"	24			
K	1 @ 25'0"	25			
L	3 @ 13'0"	39			
Steel-	2 @ 18'0"	36			
		2951 ft.			
Material and Labor Cost as of Reniger Construction Co.		.10			295.
					$295.

		Unit Cost	Labor	Mat.	Total
Lath and Plaster					
Lath					
Suspended Ceiling					
8'0" x 94'0"	752 ft.^{2}				
15'0" x 18'0"	270				
8'0" x 19'0"	152				
8'0" x 3'6"	28				
10'0" x 15'0"	150				
	1352 ft.^{2}				
Material-- 150 yd.^{2}					
ENR cost per 100 yd^2 of expanded metal lath is $30.00					
Total cost is 1.5 x 30 = $45.00					
150 yd.^{2}		.30		45.	
Labor-- 150 yd.^{2}					
Labor rate per hr is $1.50					
Labor-hr per 100 sq. yd. is 18					
Cost per 100 sq. yd is 18 x 1.5 = $27.					
Total cost is 27 x 1.5 = $41.					
150 yd.^{2}		.27	41.		
Furring (over doors along corridors)					
1st Fl. 8	4'0" x 2'0"	64 ft.^{2}			
2nd Fl. 9	4'0" x 2'0"	72			
3rd Fl. 9	4'0" x 2'0"	72			
	4'0" x 6'0"	24			
		232 ft.^{2}			
Material	26 yd.^{2}	.40		10.	
Labor		.60	16.		
Lath Stripping					
22 x 4'0"	88'0"				
2 x 18 x 11'0"	396'0"				
	484'0"				
Material	484'	.05		24.	
Labor		.05	24.		

			Unit Cost	Labor	Mat.	Total
Lath and Plaster (Con't)						
Corner Bead -- Knapp #15½ as per spec.						
42 of 12' each = 504 '						
Material	504'		.03		15.	
Labor			.10	50.		
(Berger Protex Bead)						
24	8'0"	192'				
16	8'0"	128				
6	11'0"	66				
12	8'0"	96				
3	11'0"	33				
		515'				
Material	515'		.03		15.	
Labor			.10	52.		
Plastering						
Plaster on Lathed Ceilings						
	29'0" x 32'0"	928				
6	8'0" x 16'0"	768				
	28'0" x 32'0"	896				
2	31'0" x 32'0"	1984				
3	21'0" x 35'0"	2205				
3	26'0" x 31'0"	2418				
3	26'0" x 25'0"	1950				
3	16'0" x 42'0"	2016				
	8'0" x 98'0"	784				
		13949 ft.^{2}				
Material	1550 sq. yd.		.25		388.	
Labor			.50	775.		
Plaster on Masonry						
	210'0" x 11'0"	2310				
2	8'0" x 98'0"	1584				
6	48'0" x 11'0"	3168				
2	4'0" x 14'0"	112				
2	7'0" x 14'0"	196				
2	50'0" x 11'0"	1100				
3	16'0" x 11'0"	528				
	20'0" x 61'0"	1220				

			Unit Cost	Labor	Mat.	Total
Lath and Plaster (Con't)						
Plaster on Masonry (con't)						
	204'0" x 11'0"	2244				
4	18'0" x 11'0"	792				
2	19'0" x 8'0"	304				
	204'0" x 8'0"	1632				
		15190 ft.^{2}				
	Material 1715 sq. yd.		.20		343.	
	Labor		.50	858.		
				$1816.	$840.	$2656.

CONCLUSION

Using the Engineering News Record Building Cost Index (1913 = 100), page 124, the index for May 1930, was 187.9 and for December, 1941, was 216.4. Then the building cost for 1941 equals 216.4 divided by 187.9 times the cost of the building in 1930. Since the cost of The Anatomy and Research Building in 1930 was $82,000, according to Reniger Construction Company, the cost to reproduce this building in 1941 should be:

$$82{,}000 \times \frac{216.4}{187.9} = \$94{,}300.$$

My cost estimate is $93,212. These figures do not include profit.